

THE FOURTH INSTAR LARVA AND PUPA OF THE NEOTROPICAL BITING  
MIDGE *FORCIPOMYIA (FORCIPOMYIA) RIOPLATENSIS* MARINO AND  
SPINELLI (DIPTERA: CERATOPOGONIDAE)

GUSTAVO R. SPINELLI, PABLO I. MARINO, AND MARIA M. RONDEROS

Departamento Científico de Entomología, Museo de La Plata, Paseo del Bosque s/n,  
1900 La Plata, Argentina (e-mail: spinelli@museo.fcnym.unlp.edu.ar)

---

*Abstract.*—The fourth instar larva and pupa of the Neotropical biting midge, *Forcipomyia (Forcipomyia) rioplatensis* Marino and Spinelli, are described and illustrated using phase-contrast and scanning electron microscopes. Larvae, pupae and adults of *Forcipomyia rioplatensis* were collected from nests of the monk parakeet, *Myiopsitta monachus monachus* (Boddaert), in San Vicente, Buenos Aires Province, Argentina. Larvae have character states typical of other species of *Forcipomyia* with herbivorous ceratopogonid larvae. This species is compared with its very similar Nearctic congener, *Forcipomyia (F.) bipunctataproinqua* Chan and LeRoux.

*Key Words:* Diptera, Ceratopogonidae, immatures, *Forcipomyia rioplatensis*, nest, monk parakeet, Argentina

---

*Forcipomyia* Meigen is a large and extremely diverse genus of Ceratopogonidae that is worldwide in distribution and diverse in morphology and habitat preference. The adults of some species are important pollinators of cacao and other plants of economic importance in tropical and subtropical areas (Soria et al. 1980, Chapman and Soria 1983, Young 1986).

There are now 1,028 extant described species of *Forcipomyia* (A. Borkent, personal communication). In their catalog of the Ceratopogonidae south of the United States, Borkent and Spinelli (2000) listed 203 species. Twelve species from the Neotropics were subsequently described by Marino and Spinelli (2001a, b, c, 2002, 2003) and Marino et al. (2002).

The *Forcipomyia squamitibia* group in the subgenus *Forcipomyia (Forcipomyia)* was recently reviewed for the Neotropics (Marino and Spinelli 2002). Shortly before that paper was published, we received im-

matures and adults of one of the included species, *Forcipomyia rioplatensis* Marino and Spinelli, collected by Roxana Aramburú from nests of the “monk parakeet,” *Myiopsitta monachus monachus* (Boddaert) (Aves: Psittacidae), in San Vicente, Buenos Aires Province, Argentina.

The purpose of this paper is to describe and illustrate the fourth instar larva and pupa of *Forcipomyia rioplatensis*, and compare it to the most similar congener *F. (F.) bipunctataproinqua* Chan and LeRoux, as well as to *F. (F.) elegantula* Malloch and *F. (F.) pulchrithorax* Edwards.

#### MATERIAL AND METHODS

The surveyed “monk parakeet” nests were located in trees of *Eucalyptus tereticornis* Sm. (Myrtaceae). The nesting material was composed of fragments of this tree, and to a lesser degree of *Casuarina cunninghamiana* Miq. (Casuarinaceae).

For observation with light phase-contrast

microscope, including oil immersion, some larvae and pupae were slide mounted in Canada balsam with their ventral side upward. Others were mounted dorsally and laterally to examine the chaetotaxy of the head capsule and abdominal segments of the fourth instar larva and cuticular processes of the cephalothorax, respiratory horn, and abdominal segments of the pupa. Only one side of the body is described. For examination and microphotography with the SEM (JOEL T100), larvae and pupae were mounted using the technique of Ronderos et al. (2000).

Terms follow those by Debenham (1987), and special terms of larval mouthparts follow Hribar and Mullen (1991). Voucher specimens are deposited in the collection of the Museo de La Plata, Argentina.

## RESULTS

### *Forcipomyia rioplatensis* Marino and Spinelli 2002 (Figs. 1–23)

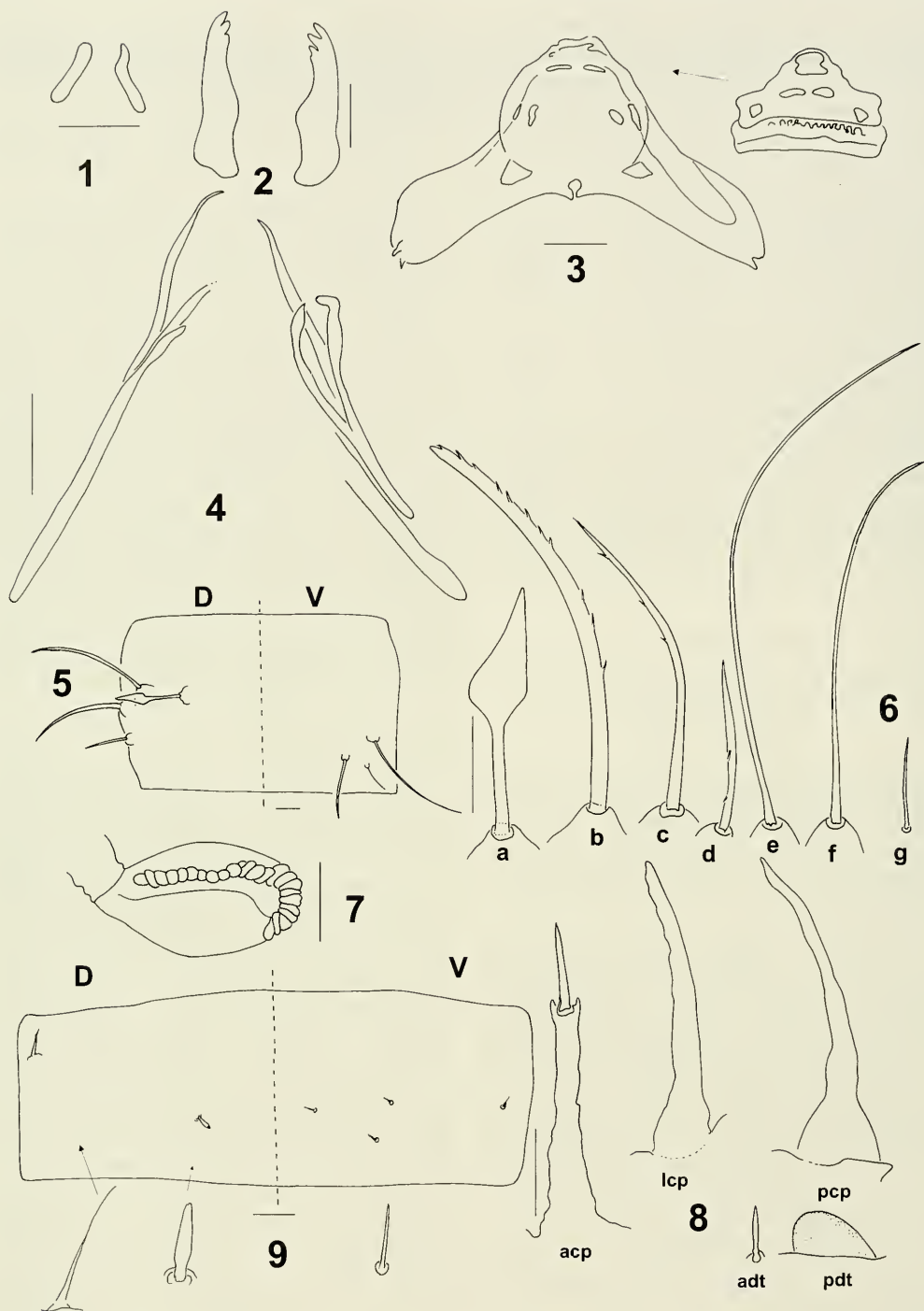
*Forcipomyia squamitibia* Lutz: Spinelli 1983: 128 (Argentina record).

*Forcipomyia rioplatensis* Marino and Spinelli 2002: 314 (female, male; Argentina).

Diagnosis of adult.—A dark brown species of the *squamitibia* group, distinguished from other members of the species group by the following combination of characters: Third palpal segment slightly swollen at base, tapering toward apex; scutum uniformly dark brown; legs brown except basal ½ of hind femur pale, knees pale; tibial hastate spines slender, pointed; spermathecae ovoid with short neck; sternite 9 with anteromesal groove; aedeagus stout, basal arch very low, tip blunt; parameres widely separated at base.

Fourth instar larva.—Exuvia pale yellowish. Head capsule (Figs. 10–11, 13) well developed, hypognathous, HL 0.43 (0.37–0.52,  $n = 7$ ) mm; HW 0.35 (0.29–0.40,  $n = 7$ ) mm; SGW not measurable; HR 1.24

(1.14–1.30,  $n = 7$ ). Head chaetotaxy (Figs. 10–11) as follows: 10 sensory setae, two pits; setae “p”, “q” lanceolate, base broad (Fig. 12); seta “s” stiff, 0.5 as long as “p”, “q”; setae “t”, “u” stout, 3–4 times longer than “s”; seta “v” thin, shorter than “u”; “r” pore simple; setae “o”, “w”, “x”, “y” minute, thin, “w” slightly stouter; “z” pore simple. Labrum (Fig. 13) short, not extending beyond hypostoma; palatum not in position to describe in detail, with at least three sensilla visible. Messors (Fig. 1) stout, comma-shaped, anterior, posterior margins blunt. Mandible (Figs. 2, 13) stout, scoop-like, not articulating with head capsule, three blunt apical teeth, ML 0.12 (0.088–0.130,  $n = 7$ ) mm; MW 0.037 (0.028–0.040,  $n = 7$ ); hypostoma (Fig. 13) smooth. Epipharynx (Fig. 3) massive, strongly sclerotized, toothed along posterior end of median sclerite, which bears conspicuous ridge; lateral arms stout, with two small, apical, pointed teeth. LAW 0.28 (0.24–0.32,  $n = 6$ ) mm; DCW 0.13 (0.11–0.14,  $n = 6$ ) mm. Hypopharynx (Fig. 4) V-shaped, strongly sclerotized, lateral arms thin projecting anteromesally; labium short, broad, not in position to describe. Maxilla (Fig. 14) with conspicuous basal fringe, palpus bearing stout seta, galeolacinia triangular, pointed. Prothoracic pseudopod (Fig. 15) bifid, each ramus with six dark brown, posteriorly directed hooks, one bifid, one medial hook smaller (Fig. 16). Chaetotaxy of second abdominal segment (Figs. 5–6): dorsally, one seta “a” pale, swollen-tipped, spear-shaped, strong base; three more simple very stout, brown chaetae evenly spaced: seta “b” with conical base, seta “c”, “d” each with rounded base, all setaceous, “d” shorter than “c”, the latter shorter than “b”; ventrally, three setae, setae “e”, “f”, stout, brown, very long, smooth, “f” shorter than “e”, seta “g” pale, short, without protruding base; cuticle with minute spicules. Anal segment (Fig. 17) with six chaetae, two of them apical, strong, setaceous, remaining four subapical insertions of strong chaetae; anal pseudo-



Figs. 1-9. Structures of immatures of *Forcipomyia rioplatensis*. 1-6, Larva. 7-9, Pupa. 1, Messors. 2, Mandibles. 3, Epipharynx (median sclerite in detail). 4, Hypopharynx. 5, Second abdominal segment. 6, Setae of second abdominal segment. 7, Respiratory horn. 8, Cuticular processes and dorsal tubercles of cephalothorax; (acp) anterior cuticular process, (lcp) lateral cuticular process, (pcp) posterior cuticular process, (adt) anterior dorsal tubercle, (pdt) posterior dorsal tubercle. 9, Setae of fourth abdominal segment.

pod bilobed, each lobe with two rows of four ventrolateral posteriorly directed hooks; anal papillae not visible; cuticle with numerous minute setae; CSL 0.21 (0.20–0.21,  $n = 2$ ) mm, CSW 0.24 (0.22–0.27,  $n = 2$ ) mm, CSR 0.87 (0.77–0.96,  $n = 2$ ).

Pupa (Fig. 18).—Length 2.86 (2.84–2.88,  $n = 2$ ) mm. Exuvia pale yellowish. Respiratory horn (Figs. 7, 20–21) small, stout, with 14–15 lateral spiracular pores, 10–11 apical ones, RH 0.18 (0.14–0.22,  $n = 6$ ) mm, P 0.022 (0.018–0.028,  $n = 6$ ) mm, PH 0.125 (0.114–0.130,  $n = 6$ ) mm. Cephalothorax (Fig. 19) with three dorsal tapering cuticular processes; anterior process with truncate tip, bearing long apical spine; lateral, posterior processes with apices finely pointed, each with apical spine absent; two rudimentary dorsal tubercles, the anterior one bearing stout seta (Fig. 8). Fourth abdominal segment (Fig. 9) with two dorsal setae: anterior one long directed anteriorly, very thin, base broad not tuberculate; posterior seta directed posteriorly, short, stout with tuberculate base; four subequal, thin ventrolateral setae, each with inconspicuous base, same length as posterior dorsal seta. Male terminal segment (Figs. 22–23) densely covered with very small spicules dorsally; genital processes dorsal, stout, tips blunt; posterolateral processes divergent, with blunt apices; length 0.42 (0.35–0.47,  $n = 4$ ) mm, width 0.27 (0.26–0.29,  $n = 4$ ) mm.

Distribution.—Argentina (Buenos Aires Province), Uruguay (Departments of Artigas and Tacuarembó).

Specimens examined in Canada balsam.—Argentina, Buenos Aires Prov., San Vicente, 15-XI-2001, R. Aramburú, 1 larva, 6 pupae with larval exuvia, 6 males, 3 females (from nests of “monk parakeets”).

Specimens examined by SEM.—Same data, 2 larvae, 2 pupae.

#### DISCUSSION

*Forcipomyia rioplatensis* is very similar to the Nearctic species *Forcipomyia bipunctataproinqua*, described in detail by

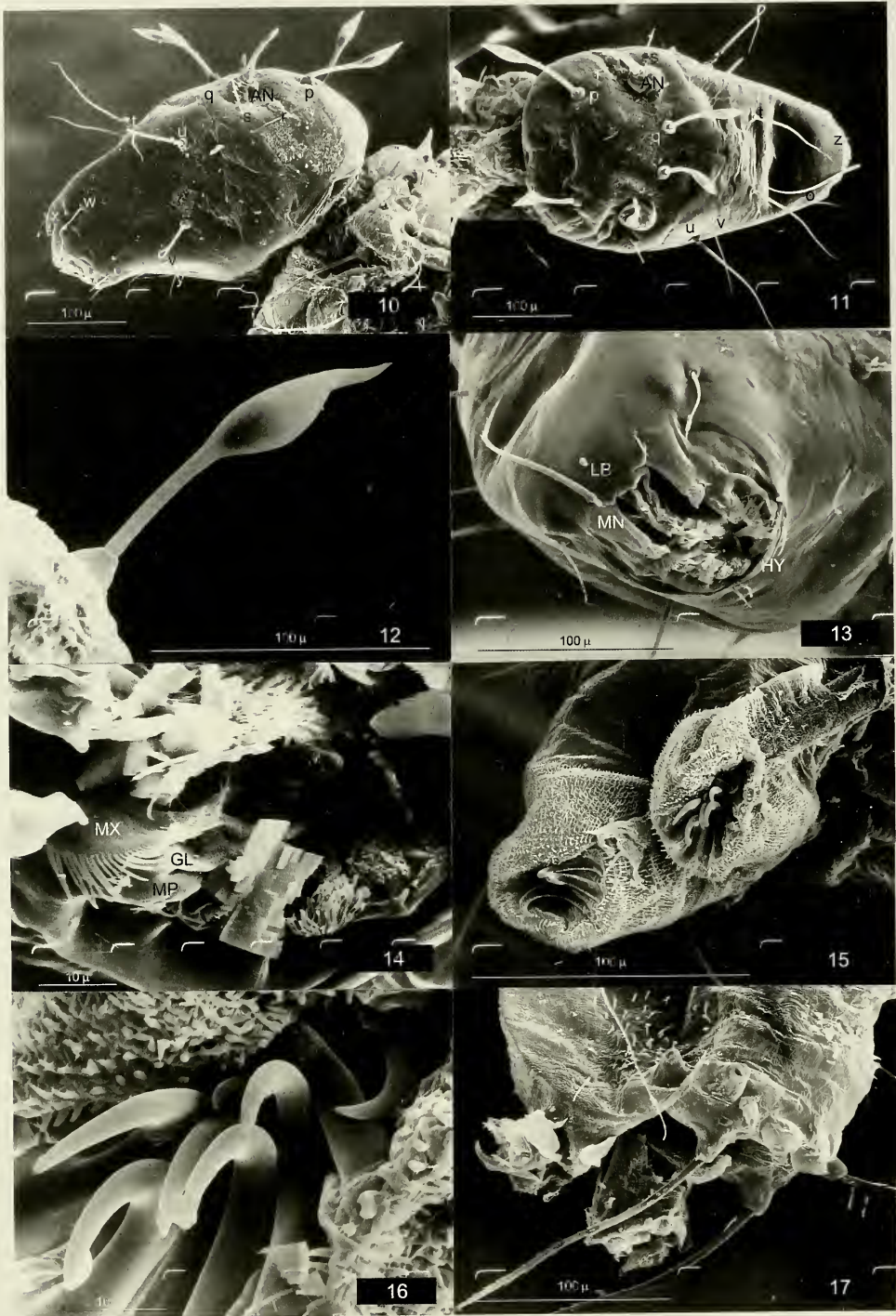
Chan and LeRoux (1971). Immatures of *F. bipunctataproinqua* can be distinguished from immatures of *F. rioplatensis* by the larval prothoracic pseudopod lacking a bifid hook and bearing three ventral smaller hooks on each ramus, by the second abdominal segment of the pupa with the anterior dorsal tubercle without a seta (anterior dorsal seta directed anteriorly with broad base, not tuberculate in *F. rioplatensis*), and by the slender male dorsal genital processes with pointed tips (stouter, with blunt tips in *F. rioplatensis*). The adult male of *F. bipunctataproinqua* can be distinguished from *F. rioplatensis* by the aedeagus with a higher basal arch, tapering distally and with a bipartite apex.

Wirth and Grogan (1978) described and illustrated the larval and pupal setae and respiratory horn of the Nearctic species *F. (F.) elegantula*, and the Palearctic one *F. (F.) pulchrithorax*. Larval abdominal setae a, b, and d of *F. pulchrithorax* are nearly identical with those of *F. rioplatensis*. Wirth and Grogan (1978) also provided a detailed SEM micrograph of the pupal respiratory horn of *F. elegantula* which has a differently shaped horn than that of *F. rioplatensis* but the surface texture is very similar to that species. In addition, the size of the spiracular pores in *F. elegantula* are similar to those of *F. rioplatensis*, but are of a different shape than in that Neotropical species.

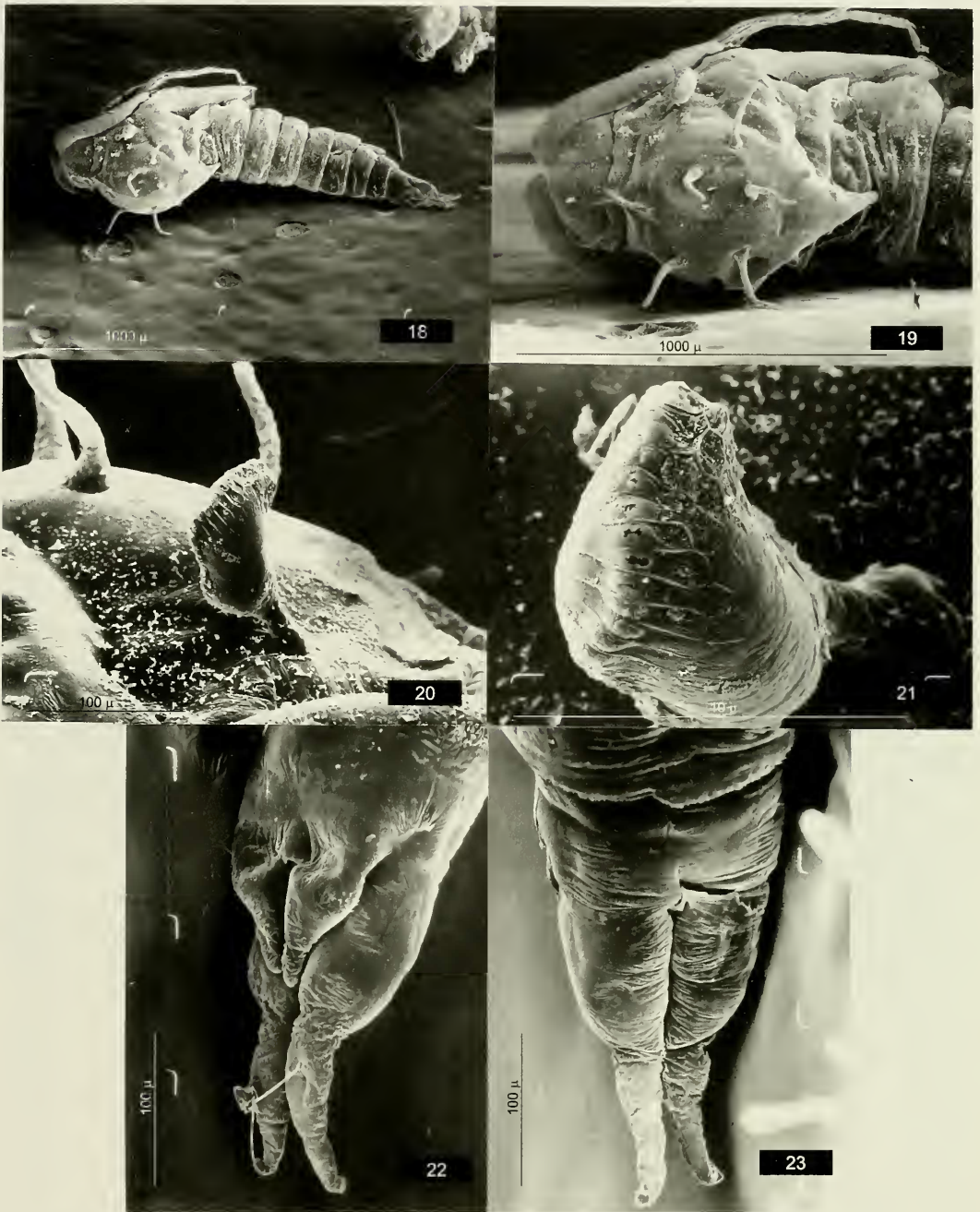
The larvae of *F. rioplatensis* exhibit the character states typical of “herbivorous” ceratopogonids: Head capsule short and stout, with mouthparts directed ventrally, well sclerotized labium, and a mandible with three teeth. Larvae most probably feed on detritus and organic matter in the nests where they live. Another possibility is that the larvae actually live under bark, like many other species of *Forcipomyia*, and eggs or larvae have moved to the nests during its construction by the monk parakeets.

#### ACKNOWLEDGMENTS

We are very grateful to Roxana Aramburú, who collected the specimens de-



Figs. 10–17. Fourth instar larva of *Forcipomyia rioplatensis*. 10, Head capsule (lateral view), chaetotaxy. 11, Head capsule (dorsal view), chaetotaxy; (AN) antennae, (x) parantennal setae, (t) anterodorsal setae, (r) frontal pits, (s) anterior perifrontal setae, (q) postfrontal setae, (w) anterolateral setae, (u) mesolateral setae, (v) posterolateral setae, (p) posterior perifrontal setae, (o) parahypostomal setae, (y) ventral setae. 12, Postfrontal seta. 13, Head capsule (anteroventral view); (LB) labrum, (MN) mandible, (HY) hypostoma. 14, Maxilla (MX), (MP) maxillary palpus, (GL) galeolacinia. 15, Prothoracic pseudopod. 16, Hooks. 17, Anal segment with insertion of setae.



Figs. 18–23. Pupa of *Forcipomyia rioplatensis*. 18, Exuvia (lateral view). 19, Cephalothorax (lateral view). 20, Respiratory horn. 21, Respiratory horn (pores in detail). 22, Male caudal segment (dorsal view). 23, Male caudal segment (ventral view).

scribed in this paper and kindly provided information on the "monk parakeet" nests. We also acknowledge Art Borkent for detailed critical review of the manuscript.

#### LITERATURE CITED

- Borkent, A. and G. R. Spinelli. 2000. Catalog of the New World biting midges south of the United States of America (Diptera: Ceratopogonidae). Contributions on Entomology, International 4(1): 1–107.
- Chan, K. L. and E. J. LeRoux. 1971. Nine new species of *Forcipomyia* (Diptera, Ceratopogonidae) described in all stages. The Canadian Entomologist 103: 729–762.
- Chapman, R. K. and S. de J. Soria 1983. Comparative *Forcipomyia* pollination of cacao in Central America and southern Mexico. Revista Theobroma 13(2): 129–139.
- Debenham, M. L. 1987. The biting midge genus *Forcipomyia* (Diptera: Ceratopogonidae) in the Australasian Region (exclusive of New Zealand) III. The subgenera *Forcipomyia*, s.s., and *Lepidohelea*. Invertebrate Taxonomy 1: 269–350.
- Hribar, L. J. and G. R. Mullen. 1991. Comparative morphology of the mouthparts and associated feeding structures of biting midge larvae (Diptera: Ceratopogonidae). Contributions of the American Entomological Institute 26(3): 1–71.
- Marino, P. I. and G. R. Spinelli. 2001a. El subgénero *Forcipomyia* (*Euprojoamisia*) en la Patagonia (Diptera: Ceratopogonidae). Gayana 65(1): 11–18.
- . 2001b. Las especies del subgénero *Forcipomyia* (*Forcipomyia*) en la Patagonia (Diptera: Ceratopogonidae). Revista de la Sociedad Entomológica Argentina 60(1–4): 99–124.
- . 2001c. Los subgéneros de *Forcipomyia*, *Thyridomyia* y *Synthyridomyia* en la Patagonia argentina, con la descripción de *F. (S.) soibelzoni* sp. n. (Diptera: Ceratopogonidae). Neotrópica 47: 13–16.
- . 2002. A revision of the *Forcipomyia squamitibia* group in the Neotropics with the description of three new species (Diptera: Ceratopogonidae). Insect Science and its Application 22(4): 307–319.
- . 2003. The Patagonian species of the subgenus *Forcipomyia* (*Metaforcipomyia*) (Diptera: Ceratopogonidae), with a key to the New World species. Insect Systematics and Evolution 34(1): 21–28.
- Marino, P. I., G. R. Spinelli, and C. G. Cazorla. 2002. Type-specimens of Ceratopogonidae (Insecta: Diptera) in the collection of the Museo de La Plata, Argentina. Publicación Técnica y Didáctica, Facultad de Ciencias Naturales y Museo, UNLP 42: 1–37.
- Ronderos, M. M., G. R. Spinelli, and P. Sarmiento. 2000. Preparation and mounting of biting midges of the genus *Culicoides* Latreille (Diptera: Ceratopogonidae) to be observed with a scanning electron microscope. Transactions of the American Entomological Society 126(1): 125–132.
- Soria, S. de J., W. W. Wirth, and R. K. Chapman 1980. Insect pollination of cacao in Costa Rica. 1. Preliminary list of the ceratopogonid midges collected from flowers. Revista Theobroma 10(2): 61–68.
- Spinelli, G. R. 1983. Notas sobre Ceratopogonidae de la República Argentina (Diptera: Nematocera) II. Nuevos aportes al conocimiento del género *Forcipomyia* Meigen. Neotrópica 29: 121–129.
- Wirth, W. W. and W. L. Grogan 1978. Notes on the systematics and biology of the biting midge, *Forcipomyia elegantula* Malloch (Diptera: Ceratopogonidae). Proceedings of the Entomological Society of Washington 80(1): 94–102.
- Young, A. M. 1986. Habitat differences in cocoa tree flowering, fruit-set, and pollinator availability in Costa Rica. Journal of Tropical Ecology 2: 163–186.